

Radiological Health, Safety and Environmental Services

A USA Environment, L.P. Company

TENORM WORKER I Training

Specific to the Bridgeton Landfill Site

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AUXIER & ASSOCIATES, INC. TENORM WORKER I Training

Specific to the Bridgeton Landfill Site

Presented by:

Auxier & Associates, Inc.
Dave Lawrence
Health Physicist
2013

SUSTAINABLE FOUNDATIONS

WHY ARE WE IN TRAINING?



This project may involve incidental contact with TENORM which stands for:

<u>Technically Enhanced Naturally Occurring</u>
<u>Radioactive Material</u>

On this Site there are potential sources of TENORM from the Uranium and Thorium series decay chain products used in mining materials.

This training covers why and how to protect yourself from these radioactive elements.

TENORM IS **E**VERYWHERE



- Technically Enhanced Naturally Occurring Radioactive Material(TENORM)
 - Radioactive materials occur naturally on the earth
 - Refining and manufacturing incorporates them into many everyday products:
 - · Cat litter
 - · Sandblasting medium
 - Refractory
 - · Ceramic glazes
 - · Gas lantern mantles
 - · Granite table tops

SUSTAINABLE FOUNDATIONS

WHAT IS THE TENORM ON THIS SITE?



- It is dirt mixed with traces of Thorium and Radium
- It came from local industries that imported it from other parts of the world
- TENORM was sent here after local industries were finished with it.

TOPICS



- · Radiation and Radioactive Material
 - Definitions
 - Terminology
 - Types of radiation
- · Biological/Health Effects
 - Short term
 - Long term
- · Radioactive Material Handling
 - Control measures, including ALARA
 - Expectations
- · Regulatory Requirements

SUSTAINABLE FOUNDATIONS

IMPORTANT TERMINOLOGY



You will hear these terms used during this project:

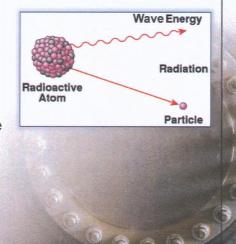
- · Radiation and Radioactive Material
- Irradiation
- Contamination
- · Curies (Ci)
- · Roentgens (R)
- Rad
- · Rem

Look for slides marked "Important Terminology" scattered throughout this training.

WHAT IS RADIATION AND RADIOACTIVE MATERIALS



- Radiation is energy given off by an unstable or excited nucleus
- · Energy in two forms:
 - Particle energy and
 - Wave or electromagnetic energy.
- Radioactive Materials are elements that give off either particle, wave energy radiation or both



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RADIATION AROUND US



- · We are exposed to radiation every day of our lives from:
 - Natural radiation.
 - Technologically enhanced natural radiation, and
 - Man-made sources of radiation medical X-rays.
- Natural radiation can be further subdivided into
 - Terrestrial (coming from the earth), and
 - Cosmic (coming from space the sun and stars).

IMPORTANT TERMINOLOGY



- We are constantly being bombarded by radiation, but are not becoming radioactive ourselves...we are being irradiated.
- The term irradiation means being exposed to radiation emitted from anyone of these radioactive sources. Being irradiated from TENORM sources does not cause something to become radioactive.

SUSTAINABLE FOUNDATIONS

IMPORTANT TERMINOLOGY



· Contamination is defined as:

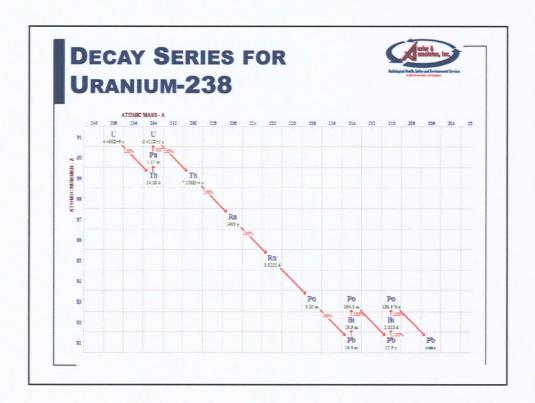
"radioactivity where it is not wanted"

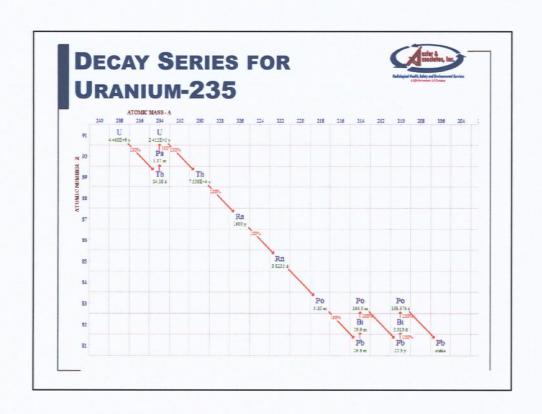
- It may exist on the surface of materials or equipment, inside materials or equipment, or distributed within the material.
- It may be found on the ground, on clothes, the surface of the skin, or even inside the body.

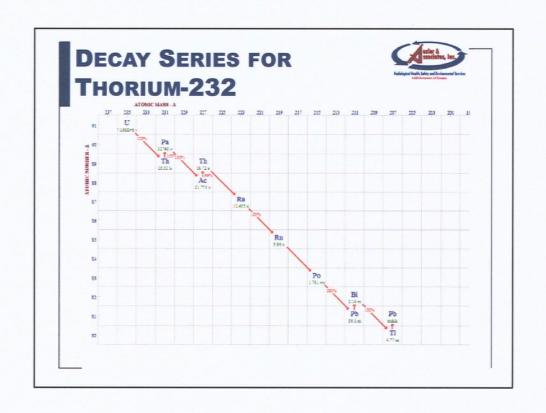
TYPES OF RADIATION

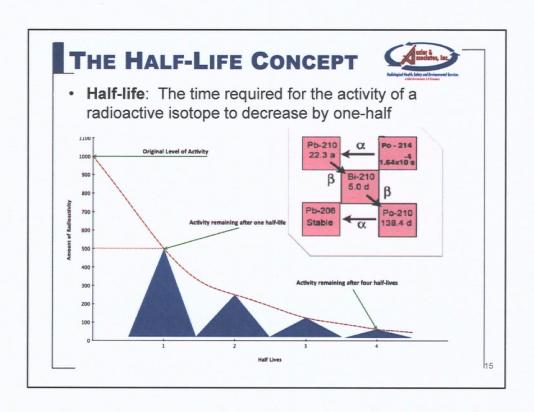


- Alpha Particle
 - Not penetrating
 - Shielded by dead skin layer
 - Hazardous if inhaled
- Beta Particle
 - More penetrating
 - Partially shielded by plastic sheeting and clothing
 - Primarily inhalation hazard for TENORM work
- · Gamma & X-Ray
 - Most penetrating
 - Requires concrete, lead or other dense material for shielding









IMPORTANT TERMINOLOGY



 So how do we define a quantity of radioactive material?

Curies (Ci) – A measurement of the amount of radioactive material.

2.22 x 10 ¹² disintegrations per minute (dpm) = 1 Ci

- A curie is a large amount of material.
- We typically deal with mCi or pCi/g levels at job sites.

DETECTION AND MEASUREMENT



- · We can not see, smell, taste or feel radiation.
- In order to detect radiation, we rely upon a variety Instruments are used to detect radiation
- Different instruments detect different types of radiation

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DETECTION AND MEASUREMENT



We will use a variety of devices to detect gamma radiation, such as:

- Ludlum 44-2
- Ludlum 44-10
- Ludlum 44-20

Which instrument used is determined by the purpose for gathering the data

DETECTION AND MEASUREMENT



For alpha and Beta contamination we will use two techniques:

- Hand scanning for TOTAL surface activity with Ludlum 44-9's and Ludlum 43-5's
- · Wipe surveys to sample removable activity

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HUMAN HEALTH AND RADIATION DOSE



So what happens when we get exposed to radiation?

HUMAN HEALTH AND RADIATION DOSE



- The main radiological health concern during the majority of Auxier & Associates' projects is the prevention of inhalation or ingestion of TENORM.
- Alpha and beta radiation do not present a significant external hazard, but they do present an internal hazard when in close contact with soft lung tissue.
- Sites associated with elevated radium concentrations may also have gamma radiation fields.

SUSTAINABLE FOUNDATIONS

How does Radiation Cause Damage?



- Inhaling or ingesting
 Alpha or Beta brings the
 radiation close to tissues
 that can be damaged
 - Lung tissue
 - Cell structures
 - Protein structures
- Result: damaged structures that can cause cancer

HUMAN HEALTH AND RADIATION DOSE



- The way a human body responds to radiation depends on a few distinct things:
 - The dose received,
 - The dose rate at which it was delivered,
 - The portion of the body exposed to that dose, and
 - The quality of the radiation that delivered the dose.

SUSTAINABLE FOUNDATIONS

IMPORTANT TERMINOLOGY



- · Roentgens (R)
- A measure of the exposure due to the radiation field around a quantity of radioactive material.
- Many detectors will measure exposure rates (energy deposited in air from radiation) in R/hr, or more commonly micro-R/hr.

IMPORTANT TERMINOLOGY



- Rad (Radiation Absorbed Dose)
- When radiation strikes your body, it deposits energy.
- The Rad is a measure of the energy deposited per unit mass.

SUSTAINABLE FOUNDATIONS

HEALTH CONCERNS



Short Term

- · "Deterministic effects" with a threshold
- · Skin burns, cataracts, GI disorders, nerve death
- Only produced by high doses/dose rates (100+ Rem)
- Acute radiation effects are typically not associated with TENORM.

HEALTH CONCERNS



Long Term

- · "Chronic" and "Stochastic" effects
- Risk-based
- · All exposures are assumed to increase risk
- Cancer

SUSTAINABLE FOUNDATIONS

IMPORTANT TERMINOLOGY



- · Rem (Roentgen equivalent man)
- It is used to describe the potential damage done by the energy deposited.
- · Takes into account the type of radiation.
- · Legal limits are expressed in Rem.

LEGAL DOSE LIMITS



NRC sets annual limits for radiation doses:

Category	Annual Limit (mrem)	Annual Limit (mSv)
Occupational, Whole Body	5,000	50
Occupational, Lens of Eye	15,000	0.15
Public, Whole Body	100	1
Declared Pregnant Worker	500/gestational period	5/gestational period
DPW, Embryo/Fetus	500/gestational period	5/gestational period

- Routine exposure rates for A&A and USA are in the area of 15 to 300 micro-rem/hr
 - 300 µrem/hr = 600 mrem/yr (for 2000 hrs)
 - 15 μrem/hr = 30 mrem/yr (for 2000 hrs)

SUSTAINABLE FOUNDATIONS

How Do WE PROTECT WORKERS?



What is ALARA?

As Low As Reasonably Achievable

ALARA is a philosophy

It means making every reasonable effort to maintain radiation exposures as far below the regulatory dose limits as practical within economic and social constraints.

How Do WE PROTECT WORKERS?



- · Avoid unnecessary exposures
 - There must be a reason (net benefit) to expose a person to radiation.
- Monitor and limit doses to safe levels
 - Regulatory limits are set to cap the amount of dose a person can receive.
- Design jobs to minimize potential exposures
 - This is where the ALARA concept is applied.

SUSTAINABLE FOUNDATIONS

How do we Protect Workers?



Auxier & Associates has prepared a Radiation Safety Plan (RSP). The RSP:

- · Identifies known radiological hazards in Area 1
- Assess potential exposures from those hazards, based on proposed activities during Phase I,
- Identifies regulatory requirements associates with those exposures, and
- Describes the controls and procedures needed to promote worker safety.

THINGS THAT PROTECT WORKERS



- Time
 - Less time means less exposure
- Distance
 - Farther away means less exposure
 - Inverse square law: double the distance from a source, you reduce dose rate by factor of 4
- Shielding
 - Barriers mean less exposure
 - Shielding may be required in some areas depending on exposure rate

SUSTAINABLE FOUNDATIONS

How is Radiation Protection Managed on a Daily Basis?



A&A will prepare job-specific Radiation Work Permits (RWPs) that:

- · Describe the work to be performed
- Describe expected radiological conditions in the work area
- Identify the Health Physicist and/or RSO managing the RWP
- · Describe the PPE required
- Identify proper monitoring & decontamination procedures

PHASE I



All activities in Area 1 require a RWP.

Every person working in radiological area of Area1 must be briefed on the RWP they will work under.

All workers working under the RWP will sign the RWP each day to document they understand and will follow the listed procedures and accept direction from the Health Physicist and/or RSO managing the RWP.

Chris Fonarev and Matt Walton will be the on-site RSO designees for this Phase of operations.

SUSTAINABLE FOUNDATIONS

IMPORTANT TERMINOLOGY



Controlled Area:

- Area inside of the fence
- · Limited access through gate

Permitted Area:

- · Smaller area managed under a RWP
- · Has one Designed Access Point
- All People entering must read and sign the RWP

ACTIVE CONTROL



- All work in Permitted Areas is conducted under a Radiation Work Permit (RWP)
 - RWP lists the required PPE for task
 - Identifies specific radiological hazards
 - Identifies anticipated dose
- All items and personnel coming out of a Permitted Area will be surveyed for free release.
- No Eating, Drinking or Smoking in the Permitted Area... this includes dipping.
- Use good hygiene practices (wash hands, etc. after working in controlled areas).

SUSTAINABLE FOUNDATIONS

MONITORING AND DOSIMETRY



- Activities will be monitored by sampling air inside the work area and
- Individuals will be issued Radiation Monitoring badges call Thermo Luminescent Detectors (TLDs).

DOSIMETRY AND REPORTING



- All Dosimetry is personal information and is confidential.
- Doses will be tracked and the total dose to individual workers will be reported within 90 days of project completion.

SUSTAINABLE FOUNDATIONS

WASTE MANAGEMENT



- Items containing excess levels of TENORM must be disposed of in a permitted disposal facility
- These items must be segregated
- Cross contamination of waste streams can result in thousands of dollars in disposal fees
- Make sure you use proper trash receptacle for TENORM waste, all bins will be clearly marked
- Only A&A and USA personnel will perform surveys for free release.

PERSONAL PROTECTIVE

EQUIPMENT (PPE)

PPE is dependent upon the task and contamination levels. This is an example of a worker in PPEs going into a heavily contaminated confined space to ascend scaffolding.

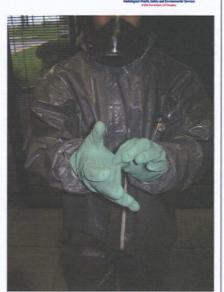


REMOVING PERSONAL PROTECTIVE EQUIPMENT (PPE)

- STEP 1 -

Gloves are most often the contaminated PPE. Learn how to properly remove gloves.

Remove outer glove by grabbing palm of one hand and pulling glove off, then ball up glove in other hand and remove to turn gloves into an inside out ball



REMOVING PERSONAL PROTECTIVE EQUIPMENT (PPE)

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Radalogial Health Salvy and Environment Service
Add Instrument, Information

- STEP 2 -

Use finger of inner gloved hand, inserted under cuff of opposite outer-gloved hand to start pulling remaining outer glove off.



REMOVING PERSONAL PROTECTIVE EQUIPMENT (PPE)



- STEP 2 -

Continue to carefully pull remaining outer glove off.



REMOVING PERSONAL PROTECTIVE EQUIPMENT (PPE)

urier & speciates, Inc.

Indialogual Health, Edward Services and Berkenson, U. Crosson

All Research, U. Crosson

- STEP 3 -

Place gloves in proper trash receptacle.



REMOVING PERSONAL PROTECTIVE EQUIPMENT (PPE)

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- STEP 4 -

Doff suit by grabbing the inside of the suit and pulling yourself out. Roll hoodie inside out to avoid dragging potentially contaminated hood down your back.



REMOVING PERSONAL PROTECTIVE EQUIPMENT (PPE)



- STEP 5 -

Push suit down around ankles and step onto inside of suit, then step off onto clean area.



CONTAMINATION CONTROL



- (CONTINUED
- Avoid touching face with gloves (wiping sweat, finger in eyes or nose, pulling respirator up to talk, etc)
- · Use dust suppression to control fugitive dust
- · Air monitoring may be required
- Leak-test nitrile/latex gloves before using
- Check gloves frequently for holes
- If material is found outside of controlled zone, isolate area and contact site RSO.
- Nothing gets thrown away in regular trash unless cleared by surveyor

CONTAMINATION CONTROL



(CONTINUED

- Example of confined space PPE requirements during a turnaround
- · Proper de-gloving technique
- Avoid cross-contamination!

SUSTAINABLE FOUNDATIONS

WHAT IF I GET CONTAMINATED?



- Use luke-warm water and a gentle rubbing with a soft cloth or brush.
- · Do not abrade the skin.
- TENORM associated with this material comes off just as any other "dirt and grime".
- The Rad Control Technician will evaluate whether there is suspected internal contamination
 - Frisking of face
 - Swab of nasal passages with Q-tip

